Applicants: RIESS et al
Serial No. 09/899,852
Response to Office Action mailed February 11, 2005

REMARKS

The application contains claims 1-19. In view of the foregoing amendments and following remarks, Applicants respectfully request allowance of the application.

At the outset, Applicants thank the Examiner for the thorough analysis of the application. Applicants have adopted many of the suggested amendments to facilitate prosecution but declined others as explained herein.

Applicants believe that an in person interview would be helpful to explain the basis of the technology represented in the pending claims and the differences between the claimed subject matter and the prior art. Applicants believe that the techniques for determining reliability are fundamentally different from those of the prior art and, therefore, the pending claims are both allowable and appropriate to the invention. Applicants had requested an interview previously but the Examiner asked to defer the interview until after submission of this response. If the Examiner elects to maintain any of the rejections from the prior Office Action, Applicants respectfully request an opportunity to interview the application before the next office action issues.

SPECIFICATION AND CLAIM OBJECTIONS

Applicants have adopted the suggestions of paragraphs 5-7 with only on exception. In paragraph 4, the equation is correct but the paragraph incorrectly refers to the coefficients as sampled values. An alternative amendment (deleting "sampled") corrects the paragraph.

Applicants have corrected the typographical errors noted in the Office Action at para. 10. No surrender of subject matter is intended by such amendments.

THE CLAIMS SATISFY 35 U.S.C. § 112, FIRST PARAGRAPH

Applicants respectfully request withdrawal of the § 112, first paragraph rejection to paragraphs 1-2, 5-8, 11-14 and 17. Although the subject matter of the present application is complicated, the specification provides ample description of the claimed subject matter.

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Applicants suggest again that an in person interview could be helpful to explain the description of the specification.

Claim 1 is supported by an enabling disclosure.

Consider claim 1, which refers to identification of reliable symbols and estimation of constellation size from a set of maximally-sized reliable symbols. On this issue, the specification states:

> From a plurality of reliable symbols, those reliable symbols having the maximum magnitude along the constellation axes (e.g. the I and Q axes of a QAM constellation) may be chosen to be the initial maximum received constellation point in each axis. An initial constellation size may be determined from the magnitude of these maximally sized reliable symbols.

Having identified the maximally-sized reliable symbols, eqs. 16-19 provide mathematical bases to establish constellation points from these maximally-sized reliable symbols. This description provides a clear direction that permits one of skill in the art to be able to practice the subject matter of claim 1.

The office action suggests that the equations represented in claims 2 and 5 are incorrect. This is not true. The equation of claim 2 represents a calculation that occurs when it is known that a transmitter is operating in the context of a square constellation. Consider, for example, a 64 point constellation (M=64), which is an 8x8 array of data points along I and Q axes. The $\hat{P}_1^{max}$ value represents the estimated constellation size and q is simply an index representing the constellation points to be estimated. As disclosed in the specification, q may run from $-\dfrac{\sqrt{M}}{2}$ to $\dfrac{\sqrt{M}}{2}$. Using the equation of claim 2, one achieves constellation points of:

q=	-4	-3	-2	-1	1	2	3	4
$\hat{P}_1^q =$	$-\dfrac{\hat{P}_1^{max}}{7}(7)$	$-\dfrac{\hat{P}_1^{max}}{7}(5)$	$-\dfrac{\hat{P}_1^{max}}{7}(3)$	$-\dfrac{\hat{P}_1^{max}}{7}$	$\dfrac{\hat{P}_1^{max}}{7}$	$\dfrac{\hat{P}_1^{max}}{7}(3)$	$\dfrac{\hat{P}_1^{max}}{7}(5)$	$\dfrac{\hat{P}_1^{max}}{7}(7)$

which is what one would expect. The formulae of claim 5 works similarly. Thus the subject matter of claims 1-2 and 5 enjoy enabling support in the specification.

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Claim 6 is supported by an enabling disclosure.

Claim 6 also enjoys an enabling disclosure in the specification. Claim 6 describes calculating a reliability factor using constellation points nearest to a plurality of samples in proximity to the candidate sample and designating the candidate sample as a reliable symbol if a certain criterion is met. This subject matter is described in paras. 25-26, for example. Mathematically, eq. 6 calls for each sample y_n to be associated with its nearest constellation point p_n. Reliability may be determined from the value of the constellation point as shown in eq. 7. As noted, the formulae of eq. 7 are extensions of eqs. 3-5. Thus, claim 6 is adequately supported by the specification. The subject matter of claims 7-8 and 11-12 are similarly supported.

Claims 13 and 17 are supported by an enabling disclosure.

Similarly, the specification provides an enabling disclosure of the subject matter of claim 13. Again, the formulae of eq. 7 describes various derivations that can occur from constellation points. One may use any of the equations to derive a value that is contributed to the reliability factor as recited in claim 14. The formulae also demonstrate scaling of the constellation points according to a coefficient c_i, which might represent any knowledge of channel effects beforehand. Thus, the specification adequately describes this subject matter.

Finally, the specification provides an enabling disclosure of the subject matter of claim 17. The subject matter is shown clearly in FIG. 6 and the associated description.

Applicants respectfully submit that the subject matter of the pending claims is clearly and accurately described by the specification. While the subject matter is complicated, it provides a description from which a worker of ordinary skill can make and use the invention. Applicants remain available to explain the subject matter of the invention in an in person interview and recommend the Examiner to contact the undersigned to review this subject matter.

35 U.S.C. § 112, SECOND PARAGRAPH REJECTIONS

Applicants respectfully request withdrawal of the outstanding indefiniteness rejections to claims 2-3, 5-6, 8, 11-14 and 17. The Office Action seems to regard reference to constellation

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points to be vague or ambiguous. Respectfully, they are not. The term "constellation points" refer to the transmission scheme operating between the transmitter and receiver. FIG. 3 illustrates several exemplary constellations.

With channel gain of unity and no ISI effects, a receiver would detect transmitted samples that coincide perfectly with the constellation points defined for transmission. Channel gain and ISI effects, of course, cause the captured samples to deviate from the ideal constellation points. Certain claims refer to estimation of where the constellation points occur with reference to the captured samples. Other claims refer to use of values of the constellation points to evaluate reliability. These claims are clear.

The Office Action also asserts that claim 1 omits essential steps by omitting a step of calculating channel gain from the constellation size. Applicants respectfully disagree. The constellation size is representative of the channel gain but permits express calculation of channel gain to be avoided. As shown in eqs. 16-19, a receiver may estimate constellation points based on the constellation size without ever expressly calculating a channel gain value (a_0). There is no essential step omitted from claim 1.

PRIOR ART REJECTIONS

The Office Action raises a host of different prior art rejections to the claims. Applicants respond below in claim order, hoping that it provides for easier review.

Independent claim 1 is allowable over Alouini and Hassan.

Claim 1 stands rejected over Alouini and Hassan. Claim 1 states:

A channel gain estimation method, comprising:
identifying reliable symbols from a sequence of captured data samples,
estimating a constellation size from a set of maximally-sized reliable symbols.

The cited art does not teach or suggest this subject matter. Alouini has almost no relationship to the pending claims. He discloses a transmitter in which two information streams (e.g., voice & data) are transmitted in separate channels. The voice channel is given as much power as necessary to ensure reliable transmission and the data channel is uses the power that remains

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available for transmission. <u>Abstract.</u> Based on the available power, <u>Alouini</u>'s system selects a constellation size to use during transmission. Col. 4:46-54.

<u>Alouini</u> does not estimate a constellation size from maximally-sized reliable symbols. He allocates a constellation size based on power available at the transmitter. By contrast, the claimed method refers to identification of reliable symbols from a sequence of captured data samples. This occurs at a receiver, not a transmitter as is used in <u>Alouini</u>'s system. So, <u>Alouini</u> allocates constellation size at a different point in the communication chain using different conditions (e.g., available power). <u>Alouini</u> is almost completely irrelevant to the claimed method. As noted earlier, <u>Hassan</u> does not teach or suggest estimation of reliable symbols from a captured data stream.

Note also that the claim refers to estimation of constellation size from maximally-sized reliable symbols, not necessarily all of the reliable symbols identified in the estimating step. No reference discloses this feature. Accordingly, the pending claims clearly define over claim 1. Applicants respectfully request withdrawal of the rejection.

Dependent claim 4 defines over <u>Alouini</u> and <u>Hassan</u>.

Claim 4 depends from claim 1 and further defines revising the estimate of the constellation size based on additional reliable symbols. As noted, <u>Alouini</u>'s decisions regarding constellation size are based on the amount of power that is available for transmission. It has nothing to do with reliable symbols, whether they are the maximally-sized reliable symbols (claim 1) or other reliable symbols (claim 4). This claim also defines over the cited art.

Independent claim 6 is not anticipated by Hassan.

Applicants respectfully suggest that <u>Hassan</u> does not anticipate claim 6 because it does not disclose all elements of that claim. Specifically, claim 6 states:

> calculating a reliability factor of a candidate sample from constellation points nearest to each of a plurality of samples in proximity to the candidate sample,
> if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol.

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Hassan does not calculate a reliability factor from samples *in proximity to the candidate sample*. While Hassan refers to "reliability" very generally, he does not identify how reliability of any specific sample is to be determined. Hassan certainly does not describe that the reliability of a candidate sample is determined from value of other samples, in proximity to the candidate sample.

According to these claims, the reliability of a particular sample (blue) is determined by examining the sample's neighbors (red).[1] The reliability factor for a candidate sample (sample t) is calculated from constellation points, which are derived from values of a plurality of samples in proximity to the candidate sample (in one embodiment, those shown in red) and, if the reliability factor is less than a predetermined limit, the candidate sample is designated as a reliable symbol.
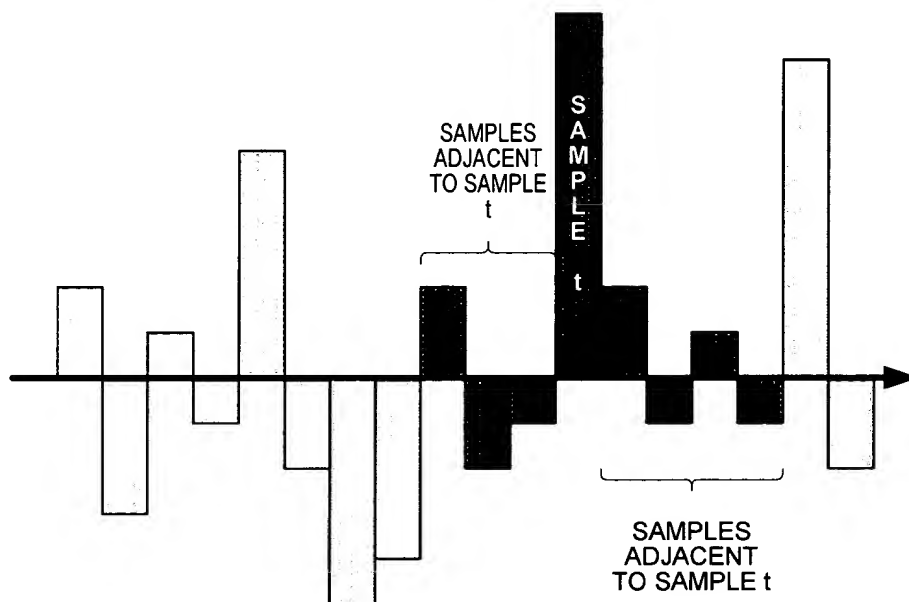

Figure 1

Hassan's system, by contrast, uses training bits. The training bits have values that are known both at the transmitter and a receiver. A detector determines a distance between the value of

_____

[1]Although claim 6 does not specify that adjacent samples are considered on both sides of the candidate samples, the illustration is useful to demonstrate conceptual differences between claim 6 and the cited art. The illustration should not be viewed as limiting the scope of the claim. Instead, claim 6 should be considered on its own terms.

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the transmitted training bits and the values that are received. <u>Hassan</u> compares the value of a received bit to a known transmitted value. He does not describe calculating a reliability factor of a sample by considering the values of proximate samples, then comparing it against a predetermined limit. Further, <u>Hassan</u> makes no mention of constellation points whatsoever. Accordingly, claim 6 defines over this art.

Dependent claims 7-12 define over the art.

Dependent claims 7 and 9-12 stand rejected as obvious over <u>Hassan</u> and secondary references such as <u>Dent</u> and <u>Isaksson</u>. Applicants respectfully request withdrawal of these rejections because the art does not teach or suggest all elements of the pending claims.

Claim 7 recites a mathematical formula for determining the reliability factor. Neither <u>Hassan</u> nor <u>Dent</u> teaches or suggests this subject matter. The sum represented in claim 7 refers to neighboring sample positions (y_{n-i}) in a data stream, for example the red samples in the foregoing illustration. <u>Dent</u> describes operations performed when merging multiple data streams received from different prongs of a RAKE receiver into a common stream. Applicants see no similarity between <u>Dent</u>'s system and the claimed invention. If the Examiner intends to maintain the rejections, Applicants respectfully request a better explanation of how support for the equation of claim 7 is found in the cited art.

More importantly, the cited portions of <u>Hassan</u> and <u>Dent</u> are not related to each other. The Office Action cites to <u>Hassan</u>'s discussion of reliability and to <u>Dent</u>'s description of RAKE decoding. Reliability and decoding are different processes. It is not clear why anyone would be motivated to apply <u>Dent</u>'s teachings to the <u>Hassan</u> system for any purposes. Applicants, therefore, respectfully submit that these references cannot be considered together for obviousness purposes.

Claims 9-12 are not rendered obvious by <u>Hassan</u> or <u>Isaksson</u>. <u>Isaksson</u> discloses switching between various constellations in certain scenarios. <u>Isaksson</u>, Abstract and Col. 2:31-44. <u>Isaksson</u> does not disclose prioritization for the purposes noted in the claims. He does not disclose prioritization based on reliability factors (claim 9) or constellation points (claim 11) nor

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does he disclose disqualification of a sample based on the sample's own value (claim 10). Therefore, claims 9-12 are patentable over this collection of art.

Independent claim 13 defines over the art.

Claim 13 stands rejected over <u>Hassan</u> and <u>Dent</u>. Applicants respectfully request withdrawal of the outstanding rejections because the cited references fail to teach or suggest all elements of the claims and because there is no motivation to combine their teachings. As noted, <u>Hassan</u> compares test bits as received to their known values to determine reliability. He does not develop a reliability factor for a sample y_n from values derived from **adjacent samples y_{n-i}.** <u>Dent</u> is directed to merger of various information streams from multiple branches of a RAKE receiver to develop a merged data stream. Furthermore, neither reference includes any disclosure to suggest that a method would use values of a sample's nearest constellation point rather than the value of the sample itself in the reliability calculation. Applicants respectfully suggest that the cited reference to not render the subject matter of claim 13 obvious. The rejection should be withdrawn.

Dependent claims 14-16 also define over the art.

Dependent claim 14 further recites that scaled value of a constellation point is added to the reliability factor. The Office Action speculates, without citation to art, that the art provides a suggestion to add this scaled value because it increases signal strength. Applicants respectfully suggest this rationale is incorrect. As recited in claim 13, a higher reliability factor causes a higher rate of rejection -- candidate samples would be **disqualified** from being considered as reliable symbols at a higher rate. As noted, <u>Hassan</u> and <u>Dent</u> are directed to very different applications than the present invention (also, from each other). The design goals cited by the Office Action have no bearing on the application for which the present invention is intended.

Dependent claims 15-16 stand rejected as obvious over <u>Hassan</u>, <u>Dent</u> and Isaksson. These claims depend from claim 13 and further recite:

> wherein the predetermined limit is $(K_1 + K_2)d_{min}$ where d_{min} is half a distance between two constellation points that are closest together in a governing constellation [claim 15];

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wherein the predetermined limit is the product of $K_1 + K_2$ and half the width of
an annular constellation ring associated with the candidate symbol [claim 16].

None of the cited art teaches or suggests this subject matter. The Office Action cited to
Isaksson at Col. 2:31-39, 2:44-51 and 20:53-57 but Isaksson does not support the rejection.

The cited discussion explains that Isaksson's system *changes constellations* based on
the nature of received data. It develops a parameter indicative of a deviation of a received
signal from a corresponding constellation point. If the parameter it outside an upper and lower
limit, it changes the constellation to another constellation. Isaksson does not teach or suggest
developing a limit *for reliability determinations* or basing such a limit on distances between
constellation points. Claims 15-16 are allowable over the prior art.

Independent claim 17 is allowable over Hassan and Isaksson.

Independent claim 17 stands rejected as obvious over <u>Hassan</u> and Isaksson. Applicants
respectfully request withdrawal of the rejection because the cited art does not teach or suggest
all elements of the pending claims, specifically:

> determining whether any of a plurality of constellation points each associated
> with samples neighboring the candidate sample is within a predetermined
> threshold,
> if none of the constellation points exceed the threshold, designating the
> candidate sample as a reliable symbol.

<u>Hassan</u> does not teach or suggest this subject matter. As noted, <u>Hassan</u> decides
reliability by comparing received values of test bits with their known values. He does not
determine whether constellation points associated with neighboring samples have values that
are within predetermined limits. Although Isaksson refers to constellation points, he does not
disclose this subject matter either. He merely discloses switching between constellation points
based on parameters detected in received data. Finally, there is no motivation to combine the
teachings of the references as the Office Action has done. <u>Hassan</u> runs tests on test bits to
determine reliability and Isaksson runs tests on received data to select a constellation. These
two processes have nothing to do with each other in communications. Claim 17 is allowable
over the prior art.

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Dependent claims 18-19 are allowable over the prior art.

Applicants respectfully request withdrawal of the obviousness rejections to dependent claims 18-19. These claims depend from claim 17 and recite:

> wherein the neighboring samples occur in a first window adjacent to the candidate sample on one side of the candidate sample [claim 18];
>
> wherein the neighboring samples occur in a pair of windows that are adjacent to, and on either side of the candidate sample [claim 19].

The Office Action asserts that these claims are obvious over Hassan, Isaksson and Temerinac. Applicants respectfully disagree. As noted above, Hassan determines reliability by a comparison of received test bits and the known values of the test bits themselves. Isaksson is directed to a completely different application, detecting changes in transmission constellations.
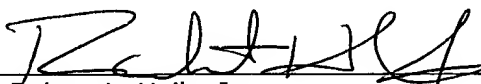
Temerinac is directed to reduction of timing errors in the presence of intersymbol interference. Abstract. While Temerinac refers to tracking windows generally, his teachings have no application to the Hassan system where the values of the transmitted test bits are known and, therefore, reliability is determined from a comparison of the received test bits and the known values. Providing a tracking window in the Hassan system would provide no further information. Accordingly, the subject matter of claims 18 and 19 is allowable over the cited art.

CONCLUSION

Applicants respectfully submit that all claims are allowable over the cited art. Allowance is solicited.

Respectfully submitted,

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